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with respect to safety in air transportation or air commerce that makes the procedures set out in this section impracticable or contrary to the public interest:

(1) The NSPM or the TPAA withdraws qualification of some or all of the simulator and makes the withdrawal of qualification effective on the day the sponsor receives notice of it.

(2) In the notice to the sponsor, the NSPM or the TPAA articulates the reasons for its finding that an emergency exists requiring immediate action with respect to safety in air transportation or air commerce or that makes it impracticable or contrary to the public interest to stay the effectiveness of the finding.

End Rule Language (§ 60.29)

21. Recordkeeping and Reporting

Begin Rule Language (§ 60.31)

a. The simulator sponsor must maintain the following records for each simulator it sponsors:

(1) The MQTG and each amendment thereto.

(2) A copy of the programming used during the evaluation of the simulator for initial qualification and for any subsequent upgrade qualification and a copy of all programming changes made since the evaluation for initial qualification.

(3) A copy of all of the following:

(a) Results of the evaluations for the initial and each upgrade qualification.

(b) Results of the quarterly objective tests and the approved performance demonstrations conducted in accordance with § 60.19(a) for a period of 2 years.

(c) Results of the previous three recurrent evaluations, or the recurrent evaluations from the previous 2 years, whichever covers a longer period.

(d) Comments obtained in accordance with § 60.9(b)(1) for a period of at least 18 months.

(4) A record of all discrepancies entered in the discrepancy log over the previous 2 years, including the following:

(a) A list of the components or equipment that were or are missing, malfunctioning, or inoperative.

(b) The action taken to correct the discrepancy.

(c) The date the corrective action was taken.

(5) A record of all modifications to simulator hardware configurations made since initial qualification.

b. The simulator sponsor must keep a current record of each certificate holder using the simulator. The sponsor must provide a copy of this list to the NSPM at least semiannually.

c. The records specified in this section must be maintained in plain language form or in coded form, if the coded form provides for the preservation and retrieval of information in a manner acceptable to the NSPM.

d. The sponsor must submit an annual

report, in the form of a comprehensive statement signed by the management representative (MR), certifying that the simulator continues to perform and handle as qualified by the NSPM.

End Rule Language (§ 60.31)

22. Applications, Logbooks, Reports, and Records: Fraud, Falsification, or Incorrect Statements

Begin Rule Language (§ 60.33)

a. No person may make, or cause to be made, any of the following:

(1) A fraudulent or intentionally false statement in any application or any amendment thereto, or any other report or test result required by 14 CFR part 60 or the QPS.

(2) A fraudulent or intentionally false statement in or a known omission from any record or report that is kept, made, or used to show compliance with 14 CFR part 60 or the QPS, or to exercise any privileges under 14 CFR chapter I.

(3) Any reproduction or alteration, for fraudulent purpose, of any report, record, or test result required under 14 CFR part 60 or the QPS.

b. The commission by any person of any act prohibited under paragraph a of this section is a basis for any one or any combination of the following:

(1) A civil penalty.

(2) Suspension or revocation of any certificate held by that person that was issued under 14 CFR chapter I.

(3) The removal of simulator qualification and approval for use in a training program.

c. The following may serve as a basis for removal of qualification of a simulator including the withdrawal of authorization for use of a simulator, or denying an application for a qualification:

(1) An incorrect statement, upon which the FAA relied or could have relied, made in support of an application for a qualification or a request for approval for use.

(2) An incorrect entry, upon which the FAA relied or could have relied, made in any logbook, record, or report that is kept, made, or used to show compliance with any requirement for a simulator qualification or an approval for use.

End Rule Language (§ 60.33)

23. Specific Simulator Compliance Requirements

Begin Rule Language (§ 60.35)

a. After [date 18 months from the effective date of the final rule], no simulator will be eligible for initial or upgrade qualification under 14 CFR part 60 unless it simulates the operation of all equipment and appliances installed and operating on the airplane being simulated, if such equipment or appliances have controls or indications that are located in the airplane cockpit.

b. After [date 2 years from the effective date of this final rule], any flight simulator

used for meeting flightcrew member training, evaluation, or flight experience requirements of 14 CFR chapter I for certification or qualification that cannot perform satisfactorily in the following areas will no longer be qualified as a simulator.

(1) Ground operations;

(2) The takeoff, climb, cruise, descent, and approach portions of the simulated airplane's operating envelope, including abnormal and emergency operations; and

(3) The landing maneuver, including normal, abnormal, and emergency landings.

End Rule Language (§ 60.35)

24. [Reserved]

25. Simulator Qualification on the Basis of a Bilateral Aviation Safety Agreement (BASA)

Begin Rule Language (§ 60.37)

a. The evaluation and qualification of an airplane simulator by a contracting State to the Convention on International Civil Aviation for the sponsor of an airplane simulator located in that contracting State may be used as the basis for issuing a U.S. statement of qualification (see attachment 5, figure 4) by the NSPM to a U.S. sponsor of that simulator in accordance with —

(1) A BASA between the United States and the Contracting State that issued the original qualification; and

(2) A Simulator Implementation Procedure (SIP) established under the BASA.

b. The SIP will contain any conditions and limitations on validation and issuance of such qualification by the U.S.

End Rule Language (§ 60.37)

Attachment 1 to Appendix A to Part 60—

General Simulator Requirements

1. General

Begin QPS Requirements

a. Requirements. (1) Certain simulator and visual system requirements included in this attachment must be supported with a Statement of Compliance and Capability (SOC) and, in designated cases, simulator performance must be recorded and the results made part of the QTG. In the following tabular listing of simulator standards, requirements for SOC's are indicated in the "Additional Details" column.

(2) Airports represented in visual scenes required by this document must be representations of real-world, operational airports or representations of fictional airports, designed specifically for use in training, testing, and/or checking of flight crewmembers.

(a) If real-world, operational airports are simulated, the visual representation and scene content is compared to that of the actual airport. This comparison requires

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accurate simulation of that airport to the extent

required by training for the qualification level
sought. It

also requires the visual scene to be modified when the airport is modified; *e.g.*, when additional runways or taxiways are added; when existing runway(s) are lengthened or permanently closed; when magnetic bearings to or from a runway are changed; when significant and recognizable changes are made to the terminal, other airport buildings, or surrounding terrain; *etc.*

(b) If fictional airports are used, the navigational aids and all appropriate maps, charts, and other navigational reference material for such airports (and surrounding areas as necessary), are evaluated for compatibility, completeness, and accuracy. These items are compared to the visual presentation and scene content of the fictional airport and require simulation to the extent required by **training for** the qualification level sought. An

SOC must be submitted that addresses navigation aid installation and performance (including obstruction clearance protection, *etc.*) and other criteria for all instrument approaches that are available in the simulator. The SOC must reference and account for information in the Terminal Instrument Procedures Manual ("Terps" Manual, FAA Handbook 8260.3, as amended) and the construction and availability of the required maps, charts, and other navigational material. This material must be appropriately marked "for training purposes only."

Comment --- Above requirements are too restrictive, and costly to implement. It will limit the quality of training (since some airports might not be modeled to meet above requirements).
End QPS Requirements

Begin Information

b. Discussion.
 qualifying airplane simulators. To determine the complete requirements for a specific level simulator the objective tests in attachment 2 and the examination of functions and subjective tests listed in attachment 3 must also be consulted.

(2) The material contained in this attachment is divided into the following categories:

- (a) General cockpit configuration.
- (b) Simulator programming.
- (c) Equipment operation.
- (d) Equipment and facilities for instructor/evaluator functions.
- (e) Motion system.
- (f) Visual system.

(g) Sound system. **--- (a) through (g): Titles in here should be same as written in Table of Minimum Simulator Requirements.**

End Information

also requires the visual scene to be modified when the airport is modified; *e.g.*, when additional runways or taxiways are added; when existing runway(s) are lengthened or permanently closed; when magnetic bearings to or from a runway are changed; when significant and recognizable changes are made to the terminal, other airport buildings, or surrounding terrain; *etc.*

(b) If fictional airports are used, the navigational aids and all appropriate maps, charts, and other navigational reference material for such airports (and surrounding areas as necessary), are evaluated for compatibility, completeness, and accuracy. These items are compared to the visual presentation and scene content of the fictional airport and require simulation to the extent set out in this document and as required by the qualification level sought. An

SOC must be submitted that addresses navigation aid installation and performance (including obstruction clearance protection, *etc.*) and other criteria for all instrument approaches that are available in the simulator. The SOC must reference and account for information in the Terminal Instrument Procedures Manual ("Terps" Manual, FAA Handbook 8260.3, as amended) and the construction and availability of the required maps, charts, and other navigational material. This material must be appropriately marked "for training purposes only."

End QPS Requirements

Begin Information

b. Discussion.
 (1) This attachment describes the minimum simulator requirements for

qualifying airplane simulators. To determine the complete requirements for a specific level simulator the objective tests in attachment 2 and the examination of functions and subjective tests listed in attachment 3 must also be consulted.

(2) The material contained in this attachment is divided into the following categories:

- (a) General cockpit configuration.
- (b) Simulator programming.
- (c) Equipment operation.
- (d) Equipment and facilities for instructor/evaluator functions.
- (e) Motion system.
- (f) Visual system.
- (g) Sound system.

End Information

TABLE OF MINIMUM SIMULATOR REQUIREMENTS

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
2. General Cockpit Configuration						
a. The simulator must have a cockpit that is a full-scale replica of the airplane simulated with controls, equipment, observable cockpit indicators, circuit breakers, and bulkheads properly located, functionally accurate and replicating the airplane. The direction of movement of controls and switches must be identical to that in the airplane.	X	X	X	X	Pilot seats must afford the capability for the occupant to be able to achieve the design "eye position" established for the airplane being simulated.	For simulator purposes, the cockpit consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats including additional, required crewmember duty stations and those required bulkheads aft of the pilot seats.
b. Those circuit breakers that affect procedures and/or results in observable cockpit indications must be properly located and functionally accurate.	X	X	X	X		
3. Programming						
a. The effect of aerodynamic changes for various combinations of drag and thrust normally encountered in flight must correspond to actual flight conditions, including the effect of change in airplane attitude, thrust, drag, altitude, temperature, gross weight, center of gravity location, and configuration.	X	X	X	X		
b. The simulator must have the computer capacity, accuracy, resolution, and dynamic response needed to meet the qualification level sought.	X	X	X	X	An SOC is required.	
c. Simulator hardware and programming must be updated within 6 months of any airplane modifications or appropriate data releases unless, with prior coordination, the NSPM authorizes otherwise.	X	X	X	X		

General Comment for all page --

“Cockpit” should be replaced with “flight deck”.
Table of Min. Req. – 2.a. --

1. “replicating the airplane” should read
“replicating the airplane to the extent defined in
Statement of Qualification”

2. Circuit breakers properly located and
functionally accurate, implies that all circuit
breakers must be functioning properly. If that is
the intent, then 2. b is redundant, and should be
deleted. OR in 2.a say that - circuit breakers
properly located (delete functionally accurate)
and then 2.b should be modified to read“....
cockpit indications must be operationally
accurate”.

3. Info. notes --- “pilot sets” should be “pilot
seats”

Table 3.a --- should read “... location and
configuration, according to available data”

Table 3.b --- Needless statement, should be
deleted. OR define requirement for each item -
computer capacity, accuracy ... etc.

Table 3.e Add. details --- In view of recorded
performance , SOC is redundant. It should be
deleted.

Table 3.g --- This requirement is part of 3.h.
should be deleted.

Table 3.h Add. details --- If information in
additional details are clear and have been
followed in the QTG, what is need for a separate
S.O.C.?

Table 3.i --- Level B should be corresponding to
300 ms

Table 3.i (2) --- Should read “... 300 milliseconds
for Level A or B simulators, or 150 milliseconds
for Level C or D simulators.”

Table 3.i (2) Add. details ---

1. What is the rationale to include “... sponsor
must also demonstrate the latency of simulator
with respect to that of the aircraft”. It is not
in AC 120-40C (or B).

2. In view of S.O.C. for proper implementation of
required transport delay methodology, and to
avoid traditional problem with the poor aircraft
data where it is hard to discern where the
parameter starts changing, item 1. above should
be deleted.

3. If item 1. above not deleted, is it intended to be
checked at initial evaluation only (and not during
subsequent recurrent evaluations), as a means to
support transport delay methodology?

Table 3.j Additional details --- S.O.C. is redundant.
Should be deleted.

Table 3.k Additional details ---

1. S.O.C. and demonstration should be clarified to be
applicable to tire failure dynamics.

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	A	B	C	D		
d. Ground operations must be represented to the extent that allows turns within the confines of the runway and adequate controls of the landing and roll-out from a crosswind approach to a landing.	X					
e. Ground handling and aerodynamic programming must include the following:					An SOC is required. Simulator performance must be recorded and the results made part of the QTG.	
(1) Ground effect		X	X	X	This requires data on lift, drag, pitching moment, trim, and power while in ground effect.	Applicable areas include: rollout, flare, and touchdown.
(2) Ground reaction		X	X	X	This requires data on strut deflections, tire friction, side forces, etc.	This is the reaction of the airplane upon contact with the runway during landing, and may differ with changes in gross weight, airspeed, rate of descent on touchdown, etc.
(3) Ground handling characteristics, including aerodynamic and ground reaction modeling including steering inputs, operations with crosswind, braking, thrust reversing, deceleration, and turning radius.		X	X	X		
f. The simulator must employ windshear models that provide training for recognition of windshear phenomena and the execution of recovery procedures. Models must be available to the instructor/evaluator for the following critical phases of flight:			X	X	Required only for turbo-jet powered, transport category airplanes. Simulator performance must be recorded and the results made part of the QTG; see Attachment 6 of this appendix. The QTG must reference the FAA Windshear Training Aid or present alternate airplane related data, including the implementation method(s) used. If the alternate method is selected, wind models from the Royal Aerospace Establishment (RAE), the Joint Airport Weather Studies (JAWS) Project and other recognized sources may be implemented, but must be supported and properly referenced in the QTG. Only those simulators meeting these requirements may be used to satisfy the training requirements of part 121 pertaining to a certificate holder's approved low-altitude windshear flight training program as described in § 121.409.	If desired, Level A and B simulators may qualify for windshear training by meeting these standards; see Attachment 6 of this appendix. Windshear models may consist of independent variable winds in multiple simultaneous components. The FAA Windshear Training Aid presents one acceptable means of compliance with simulator wind model requirements.
(1) Prior to takeoff rotation						
(2) At liftoff						
(3) During initial climb						
(4) On final approach, below 500 ft. AGL						
g. The simulator must include a means for quickly and effectively testing simulator programming and hardware.			X	X	An SOC is required	This may include an automated system, which could be used for conducting at least a portion of the tests in the QTG.

2. “A demonstration is required for initial and recurrent evaluations”. Initial and recurrent evaluations words are mentioned in reference to performance recording as in “Simulator performance must be recorded for decrease”. Per 60.19 (a) (1) demonstrations and performances must be inspected once in a year. For purposes of consistency (and to avoid misinterpretation that perhaps performance should be done only once), please remove phrase “initial and recurrent evaluations” from demonstrations or add this phrase for performance records.

Table 3.l --- We understand this to be demonstrated via the FSD Qualification Guidance for Simulator Icing Effects on NSP website. Should not contents of guidance be included in Information Notes?

Table 3.m ---

A. Item (3) “Effect of Icing” is redundant in view of 3.l. Should be deleted.

B. Item (1) “Low altitude level flight ground effect” are recorded tests, so should not require S.O.C.

C. “Simulator performance must be recorded”. Not clear as to what does it apply to?

Table 3.n --- In view of the QA program, this item should be deleted.

Table 3.k Additional details ---

1. S.O.C. and demonstration should be clarified to be applicable to tire failure dynamics.

2. “A demonstration is required for initial and recurrent evaluations”. Initial and recurrent evaluations words are mentioned in reference to performance recording as in “Simulator performance must be recorded for decrease”. Per 60.19 (a) (1) demonstrations and performances must be inspected once in a year. For purposes of consistency (and to avoid misinterpretation that perhaps performance should be done only once), please remove phrase

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“initial and recurrent evaluations” from demonstrations or add this phrase for performance records.

Table 3.l --- We understand this to be demonstrated via the FSD Qualification Guidance for Simulator Icing Effects on NSP website. Should not contents of guidance be included in Information Notes?

Table 3.m ---

A. Item (3) – “Effect of Icing” is redundant in view of 3.l. Should be deleted.

B. Item (1) – “Low altitude level-flight ground effect” are recorded tests, so should not require S.O.C.

C. “Simulator performance must be recorded”. Not clear as to what does it apply to?

Table 3.n --- In view of the OA program, this item should be deleted.

Table 4.c --- Typo “gound” should be “ground”.

Table 4.d --- Typo “... simulator must be also ...” should be “... simulator must also ...”.

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TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
h. The simulator must provide for automatic testing of simulator hardware and software programming to determine compliance with simulator objective tests as prescribed in Attachment 2.			X	X	An SOC is required. Simulator test results must include simulator number, date, time, conditions, tolerances, and appropriate dependent variables portrayed in comparison to the airplane standard.	Automatic "flagging" of out-of-tolerance situations is encouraged.
i. Relative responses of the motion system, visual system, and cockpit instruments must be coupled closely to provide integrated sensory cues.	X				Response must be within 300 milliseconds of the airplane response.	
		X	X	X	Response must be within 150 milliseconds of the airplane response.	
(1) Latency: These systems must respond to abrupt input at the pilot's position. The response must not be prior to that time when the airplane responds and may respond up to 150/300 milliseconds after that time. Visual change may start before motion response, but motion acceleration must be initiated before completion of the visual scan of the first video field containing different information.					Simultaneously record: the analog output from the pilot's control column, wheel, and pedals; the output from an accelerometer attached to the motion system platform located at an acceptable location near the pilots' seats; the output signal to the visual system display (including visual system analog delays); and the output signal to the pilot's attitude indicator or an equivalent test approved by the Administrator. Simulator performance must be recorded. These results must be compared to airplane response data in the takeoff, cruise, and approach or landing configuration and must be recorded in the QTG.	The intent is to verify that the simulator provides instrument, motion, and visual cues that are, within the stated time delays, like the airplane responses. Acceleration in the appropriate rotational axis is preferred. Simulator Latency is measured from the start of a control input to the appropriate perceivable change in flight instrument indication; visual system response; or motion system response.
(2) Transport Delay: (As an alternative to the Latency requirement, above, a transport delay demonstration may be used to demonstrate that the simulator system does not exceed the specified limit of 300 milliseconds for Level A simulators or 150 milliseconds for Level B, C, or D simulators. The sponsor must measure all the delay encountered by a step signal migrating from the pilot's control through the control loading electronics and interfacing through all the simulation software modules in the correct order, using a handshaking protocol, finally through the normal output interfaces to the instrument displays, the motion system, and the visual system).					An SOC is required. A recordable start time for the test must be provided with the pilot flight control input. The migration of the signal must permit normal computation time to be consumed and must not alter the flow of information through the hardware/software system. While transport delay need only be measured once in each axis, independent of flight conditions, if this method is chosen, the sponsor must also demonstrate the latency of the simulator with respect to that of the aircraft with at least one demonstration in pitch, in roll, and in yaw as described above. Simulator performance must be recorded and the results must be recorded in the QTG.	The transport delay is the delay time between the control input and the individual hardware (i.e., instruments, motion system, visual system) responses.
j. The simulator must accurately reproduce the stopping time and distances for at least the following runway conditions:			X	X	An SOC is required. Simulator performance must be recorded and the results made part of the QTG.	Objective tests are described in Attachment 2 for dry, wet, and icy runway conditions.
(1) Patch Wet (2) Patch Icy						

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Table 5.a --- Please append at the end of the para. "within the limitations of airplane cockpit layout"

Table 5.b --- 1. "... all required system variables ...". This term is very vague. Should be defined.
2. "... abnormal or emergency conditions ..."
should read as "... abnormal or emergency conditions as described in sponsor's approved training program".

Table 5.c --- This para is subset of para 5.b.
Should be deleted.

Table 5.d --- Contents of 5.d and 7.e should be combined in (modified) 5.d under the title of "Instuctor or Evaluator Visual Control".

Table 6.b, 6.c and 6.d --- SOC should be deleted in view of information being available in Attachment 5 Figure 3

Table 6.c. --- Why is Level B required to meet a minimum of 4 dof? AC 120-40B and 120-40C require 3dof.

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Table 7.b and 7.c --- SOC should be deleted in view of Attachment 5 Figure 4A.

Table 7.e --- Move contents to 5.d, and delete 7.e.

Table 7.f and 7.m --- If sponsor has more than three airport scenes available, is it NSPM intent to evaluate all these scenes at initial and recurrent evaluations, or will TPAA evaluate scenes that are in excess of three?

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TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
(3) Wet on Rubber Residue in Touchdown Zone						
k. The simulator must accurately simulate brake and tire failure dynamics (including antiskid failure) and decreased brake efficiency due to high brake temperatures.			X	X	An SOC is required. A demonstration is required for initial and recurrent evaluations. Simulator performance must be recorded for decreased braking efficiency due to brake temperature and the results made part of the QTG.	Simulator pitch, side loading, and directional control characteristics should be representatives of the airplane.
l. The simulator must replicate the effects of airframe icing.			X	X	A demonstration is required for initial and recurrent evaluations.	
m. The aerodynamic modeling in the simulator must include: (1) Low-altitude level-flight ground effect; (2) Match effect at high altitude; (3) Effects of airframe icing; (4) Normal and reverse dynamic thrust effect on control surfaces; and (5) Aeroelastic representations of nonlinearities due to sideslip.				X	An SOC is required and must include references to computations of aeroelastic representations and nonlinearities due to sideslip. A demonstration of icing effects is required for initial and recurrent evaluations. Simulator performance must be recorded and the results made a part of the QTG.	See Attachment 2, paragraph 4, for further information on ground effect.
n. The simulator must have a software and hardware control methodology that is supported by diagnostic analysis programs(s) and resulting printouts.				X	An SOC is required.	
4. Equipment Operation						
a. All relevant instrument indications involved in the simulation of the airplane must automatically respond to control movement or external disturbances to the simulated airplane; e.g., turbulence or windshear.	X	X	X	X	Numerical values must be presented in the appropriate units for U.S. operations.	For example, fuel in pounds, speed in knots, and altitude in feet.
b. Communications and navigation equipment must be installed and operate within the tolerances applicable for the airplane.	X	X	X	X	.....	See Attachment 3, paragraph 1c for further information regarding long-range navigation equipment.
c. Simulator systems must operate as the airplane systems would operate under normal, abnormal, and emergency operating conditions on the ground and in flight.	X	X	X	X		
d. The simulator must provide pilot controls with control force and control travel that correspond to the simulated airplane. The simulator must be also react in the same manner as in the airplane under the same flight conditions.	X	X	X	X		
5. Instructor or Evaluator Facilities						

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Table 7.h --- Intent of this paragraph is not clear.
Please provide specifics as information notes.

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Table 7.1 (2) --- 1). Information notes should be moved to 7.1 (1) - 2). Since there is no requirement of SOC in 7.n – which is of similar technical nature as 7.1 (2), SOC for 7.1 (2) should be deleted.

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Tables 7.p --- Should not be applicable to Level C, per AC120-40C. Also the required test is not capable of being used for Level C as there is not enough light to see that far during dusk or night.

Table 7.s --- Additional details – "... These requirements are applicable to any level of simulator" should to be highlighted in such a way that it is 'marked' for Level A, B and C also. As is reader will read this paragraph only for Level D requirements.

Clarification --- If a visual system capable of day-light scene, that is qualified at Level C and not used in training for any credits, will the above requirement apply to this simulator?

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TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
a. In addition to the flight crew member stations, the simulator must have two suitable seats for the instructor/check airman and FAA inspector. These seats must provide adequate vision to the pilot's panel and forward windows.	X	X	X	X	All seats other than flight crew seats need not represent those found in the airplane but must be equipped with similar positive restraint devices.	The NSPM will consider alternatives to this standard for additional seats based on unique cockpit configurations.
b. The simulator must have controls that enable the instructor/evaluator to control all required system variables and insert all abnormal or emergency conditions described in the sponsor's pilot operating manual into the simulated airplane systems.	X	X	X	X		
c. The simulator must have instructor controls for wind speed and direction.	X	X	X	X		
d. The simulator must provide the instructor or evaluator the ability to present ground and air hazards.			X	X	.....	For example, another airplane crossing the active runway and converging airborne traffic; etc.
6. Motion System						
a. The simulator must have motion (force) cues perceptible to the pilot that are representative of the motion in an airplane.	X	X	X	X	.....	For example, touchdown cues should be a function of the rate of descent (RoD) of the simulated airplane.
b. The simulator must have a motion system with a minimum of three degrees of freedom.	X				An SOC is required.	
c. The simulator must have a motion system with a minimum of four degrees of freedom (at least pitch, roll, sway, and heave).		X			An SOC is required.	
d. The simulator must have a motion (force cueing) system that produces cues at least equivalent to those of a six-degrees-of-freedom, synergistic platform motion system.			X	X	An SOC is required.	
e. The simulator must provide special effects programming that includes the following: (1) Thrust effect with brakes set. (2) Runway rumble, oleo deflections, effects of ground speed and uneven runway characteristics. (3) Buffets on the ground due to spoiler/speedbrake extension and thrust reversal. (4) Bumps after lift-off of nose and main gear. (5) Buffet during extension and retraction of landing gear. (6) Buffet in the air due to flap and spoiler/speedbrake extension.		X	X	X	A qualitative assessment is required to determine that the effect is representative of the airplane simulated.	

TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
(7) Stall buffet to, but not necessarily beyond, the FAA certificated stall speed, V_{st} , if applicable. (8) Representative touchdown cues for main and nose gear. (9) Nosewheel scuffing, if applicable. (10) Mach buffet.						
f. The simulator must provide characteristic buffet motions that result from operation of the airplane, or from atmospheric disturbances, which can be sensed in the cockpit; e.g., high-speed buffet, extended landing gear or flaps, nosewheel scuffing, stall buffet, air turbulence, etc.				X	Simulator performance (with emphasis on amplitude and frequency) must be recorded and compared to airplane data. The results must be made a part of the QTG. For air turbulence, general purpose disturbance models that approximate demonstrable flight test data are acceptable.	The simulator should be programmed and instrumented in such a manner that the characteristic buffet modes can be measured and compared to airplane data.
7. Visual System						
a. The simulator must have a visual system providing an out-of-the-cockpit view.	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
b. The simulator must provide a continuous minimum collimated field of view of 45° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously.	X	X			An SOC is required.	
c. The simulator must provide a continuous minimum collimated visual field of view of 75° horizontally and 30° vertically per pilot seat. Both pilot seat visual systems must be operable simultaneously.			X	X	An SOC is required. Wide angle systems providing cross cockpit viewing (for both pilots simultaneously) must provide a minimum field of view of 150° horizontally.	
d. The simulator must have operational landing lights for night scenes.	X	X	X	X	A demonstration is required for initial and recurrent evaluations. Where used, dusk (or twilight) scenes require operational landing lights.	
e. The simulator must have instructor controls for the following: (1) Cloudbase. (2) Visibility in statute miles (km) and runway visual range (RVR) in ft. (m). (3) Airport selection. (4) Airport lighting.	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
f. Each airport scene displayed must include the following: (1) Airport runways and taxiways. (2) Runway definition. (i) Runway surface and markings. (ii) Lighting for the runway in use, including runway threshold, edge, centerline, touchdown zone, VASI (or PAPI), and approach lighting of appropriate colors.	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	

Table 8.b — Should not “normal engine and thrust reversal sounds, and other sounds of flaps, gear and spoiler extension and retraction” be read after “... other significant airplane noises”?

Table 8.c — Additional details: 1). What is paragraph 4.w? 2). “... and airframe sounds” should read as “... and airframe sounds according to available data”

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TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

General simulator requirements	QPS requirements				Additional details	Information notes
	Simulator level					
	A	B	C	D		
(iii) Taxiway lights.						
g. The distances at which runway features are visible, as measured from runway threshold to an airplane aligned with the runway on an extended 3° glide slope must not be less than listed below:	X	X	X	X	A demonstration is required for initial and recurrent evaluations.	
(1) Runway definition, strobe lights, approach lights, runway edge white lights and Visual Approach Slope Indicator (VASI) or Precision Approach Path Indicator (PAPI) system lights from 5 statute miles (8 kilometers (km)) of the runway threshold.						
(2) Runway centerline lights and taxiway definition from 3 statute miles (4.8 km)..						
(3) Threshold lights and touchdown zone lights from 2 statute miles (3.2 km)..						
(4) Runway markings within range of landing lights for night scenes; as required by three (3) arc-minutes resolution on day scenes..						
h. The simulator must provide visual system compatibility with aerodynamic programming.	X	X	X	X		
i. The simulator must be verified for visual ground segment and visual scene content for the airplane in landing configuration and a main wheel height of 100 feet (30 meters) above the touchdown zone. Data submitted must include at least the following: (1) Static airplane dimensions as follows: (i) Horizontal and vertical distance from main landing gear (MLG) to glideslope reception antenna. (ii) Horizontal and vertical distance from MLG to pilot's eyepoint. (iii) Static cockpit cutoff angle. (2) Approach data as follows: (i) Identification of runway. (ii) Horizontal distance from runway threshold to glideslope intercept with runway.	X	X	X	X	The QTG must contain appropriate calculations and a drawing showing the pertinent data used to establish the airplane location and the segment of the ground that is visible considering the airplane attitude (cockpit cut-off angle) and a runway visual range of 1,200 feet or 350 meters. Simulator performance must be measured against the QTG calculations. Sponsors must provide this data for each simulator (regardless of previous qualification standards) to qualify the simulator for all precision instrument approaches. (iii) glideslope angle. (iv) Airplane pitch angle on approach. (3) Airplane data for manual testing: (i) Gross weight. (ii) Airplane configuration. (iii) Approach airspeed.	
j. The simulator must provide visual cues necessary to assess sink rates (provide depth perception) during landings, to include: (1) Surface on runways, taxiways, and ramps. (2) Terrain features.		X	X	X	A demonstration is required for initial and recurrent evaluations.	

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Attachment 2 to Appendix A to Part 60—Simulator Objective Tests 1. General Begin QPS Requirements
a. Test requirements—(1) The ground and flight tests required for qualification are listed in the following Table of Objective Tests. Computer generated simulator test results must be provided for each test. If a flight condition or operating condition is required for the test but which does not apply to the airplane being simulated or to the qualification level sought, it may be disregarded (for example: An engine out missed approach for a single engine airplane; a maneuver using reverse thrust for an airplane without reverse thrust capability; a landing test for a Level A simulator; etc.).

Each test result is compared against Flight Test Data described in § 60.13, and Paragraph 9 in the main body of this appendix. Although use of a driver program designed to automatically accomplish the tests is encouraged for all simulators and required for Level C and Level D simulators, each test must be able to be accomplished manually while recording all appropriate parameters. The results must be produced on a multichannel

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TABLE OF MINIMUM SIMULATOR REQUIREMENTS—Continued

QPS requirements					Additional details	Information notes
General simulator requirements	Simulator level					
	A	B	C	D		
(1) The simulator visual system must provide a minimum contrast ratio of 5:1.					A raster-drawn pattern must be displayed that fills the entire visual scene (3 or more channels) consisting of a matrix of black and white squares no larger than 10° and no smaller than 5° per square, with a white square having a minimum threshold value of 2 foot-lamberts, or 7 cd/m ² in the center of each channel. The contrast ratio is the numerical value of the brightness measured for the center (white) square divided by the brightness value for any adjacent (dark) square.	A 1° spot photometer is used to measure the brightness values.
(2) The simulator visual system must provide a highlight brightness of not less than six (6) foot-lamberts (20 cd/m ²).					The test must use the full pattern described above, measuring the brightness of a white square, superimposed completely with a highlighted area covering the square. Use of calligraphic capabilities to enhance raster brightness is acceptable; however, individual light points or light point arrays are not acceptable.	A 1° spot photometer is used to measure the brightness values.
t. The simulator must provide operational visual scenes that portray physical relationships known to cause landing illusions to pilots.				X	A demonstration is required for initial and recurrent evaluations.	For example: short runways, landing approaches over water, uphill or downhill runways, rising terrain on the approach path, unique topographic features, etc.
u. The simulator must provide special weather representations of light, medium, and heavy precipitation near a thunderstorm on take-off and during approach and landing.				X	A demonstration is required for initial and recurrent evaluations. Representations need only be presented at and below an altitude of 2,000 ft. (610 m) above the airport surface and within 10 miles (16 km) of the airport.	
v. The simulator must present visual scenes of wet and snow-covered runways, including runway lighting reflections for wet conditions, partially obscured lights for snow conditions, or suitable alternative effects.				X	A demonstration is required for initial and recurrent evaluations.	
w. The simulator must present realistic color and directionality of all airport lighting.				X	A demonstration is required for initial and recurrent evaluations.	
8. Sound System						
a. The simulator must provide cockpit sounds that result from pilot actions that correspond to those that occur in the airplane.	X	X	X	X		

recorder, line printer, or other appropriate recording device acceptable to the NSPM. Time histories are required unless otherwise indicated in the Table of Objective

Tests. All results must be labeled using the appropriate tolerances and units given.
(2) The Table of Objective Tests in this

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attachment sets out the test results required, including the parameters, tolerances, and flight conditions for simulator validation. Tolerances are provided for the listed tests because aerodynamic modeling and acquisition/development of reference data are often inexact. All tolerances listed in the following tables are applied to simulator performance. When two tolerance values are given for a parameter, the less restrictive may be used unless otherwise indicated.

(3) Certain tests included in this attachment must be supported with a Statement of Compliance and Capability (SOC). In the following tabular listing of simulator tests, requirements for SOC's are indicated in the "Test Details" column.

In view of objective tests in this Attachment, SOC is redundant.

(4) When operational or engineering judgment is used in making assessments for flight test data applications for simulator validity, such judgment must not be limited to a single parameter. For example, data that exhibit rapid variations of the measured parameters may require interpolations or a "best-fit" data selection. All relevant parameters related to a given maneuver or

flight condition must be provided to allow overall interpretation. When it is difficult or impossible to match simulator to airplane data throughout a time history, differences must be justified by providing a comparison of other related variables for the condition being assessed.

(5) Unless noted otherwise, simulator tests must represent airplane performance and handling qualities at operating weights and centers of gravity (CG) typical of normal operation. If a test is supported by airplane data at one extreme weight or CG, another test supported by airplane data at mid conditions or as close as possible to the other extreme must be included, except as may be authorized by the NSPM. Tests of handling qualities must include validation of augmentation devices.

(6) When comparing the parameters listed to those of the airplane, sufficient data must also be provided to verify the correct flight condition and airplane configuration changes. For example: to show that control force is within ± 5 pounds (2.2 daN) in a static stability test, data to show the correct airspeed, power, thrust or torque, airplane configuration, altitude, and other appropriate datum identification parameters must also be

given. If comparing short period dynamics, normal acceleration may be used to establish a match to the airplane, but airspeed, altitude, control input, airplane configuration, and other appropriate data must also be given. If comparing landing gear change dynamics, pitch, airspeed, and altitude may be used to establish a match to the airplane, but landing gear position must also be provided. All airspeed values must be clearly annotated as to indicated, calibrated, etc., and like values used for comparison.

(7) The QTG provided by the sponsor must describe clearly and distinctly how the simulator will be set up and operated for each test. Overall integrated testing of the simulator must be accomplished to assure that the total simulator system meets the prescribed standards; i.e., it is not acceptable to test only each simulator subsystem independently. A manual test procedure with explicit and detailed steps for completion of each test must also be provided.

(8) In those cases where the objective test results authorize a "snapshot" result in lieu of a time history result, the sponsor must
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ensure that a steady state condition exists from 5 seconds prior to, through 2 seconds after, the instant of time captured by the "snapshot."

(9) For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent recurrent evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) Simulators are evaluated and qualified with an engine model simulating the airplane manufacturer's flight test engine. For qualification of alternate engine models (either variations of the flight test engines or other manufacturer's engines) additional simulator tests with the alternate engine models are required. Where thrust is different by more than 5% from the flight test engine, flight test data from an airplane equipped with the alternate engine is required. Where the airplane manufacturer certifies that the only impact on the simulator model is thrust, and that other variables related to the alternate engine (such as drag and thrust vector) are unchanged or are insignificantly changed, additional simulator tests may be run with the same initial conditions using the thrust from the flight test data as a driven parameter for the alternate engine model. Please specify additional tests required for qualification of alternate engine when thrust difference from the flight test engine is a) less than 5% and b) more than 5%.

(11) Motion System Tests:

(a) The minimum excursions, accelerations, and velocities for pitch, roll, and yaw must be measurable about a single, common reference point and must be achieved by driving one degree of freedom at a time.

(b) The minimum excursions, accelerations, and velocities for heave, sway, and surge may be measured about different but identifiable reference points and must also be achieved by driving one degree of freedom at a time.

(12) For testing Computer Controlled Airplane (CCA) simulators, or other highly augmented airplane simulators, flight test data are required for both the Normal (N) and Non-normal (NN) control states, as indicated require data only in the Normal control state and are so noted. Where test results are independent of control state, Non-normal control data may be used. Tests for other levels of control state degradation may be required as detailed by the NSPM at the time of definition of a set of specific airplane tests for simulator data. Where Non-normal control states are required, test data must be provided for one or more Non-normal control states, and must include the least augmented state. All tests in the Table of Objective Tests require test results in the Normal control state unless specifically noted otherwise in the additional requirements section following the CCA designation. Where applicable, flight test data must record Normal and Non-normal states for:

(a) Pilot controller deflections or electronically generated inputs, including location of input; and

(b) Flight control surface positions unless test results are not affected by, or are independent of, surface positions.

(13) For computer controlled airplanes using airplane hardware (e.g., "side stick controller") in the simulator cockpit, some tests will not be required. Those tests are annotated in the "Additional Requirements" column with the Computer Controlled Airplane (CCA) note "test not required if cockpit controller is installed in the simulator." However, in these cases the sponsor must supply a statement that the airplane hardware meets and will continue to meet the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for NSPM review.

End QPS Requirements

b. Discussion

Begin Information

(1) If relevant winds are present in the (and direction) should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

(2) The NSPM will not evaluate any simulator unless the required SOC indicates that the motion system is designed and manufactured to safely operate within the simulator's maximum excursion, acceleration, and velocity capabilities (see paragraph 3, Motion System, in the following table).

SOC is redundant if safety checks have carried out as part of approved QA program.

(3) In the following Table of Objective Tests, the last column is titled "Paragraph 8." A "yes" indication in that column directs the reader to paragraph 8 of this attachment for additional information relative to sources of data, procedures used to acquire the data, and instrumentation that may be used, as an alternative to those expected under normal flight test procedures—and—that may be used for that particular test for Level A or Level B simulators. Paragraph 8 also contains notes, reminders, and information applicable to that particular test for those simulator levels. These data sources, procedures, and instrumentation, if used, would be submitted in accordance with the alternative data provisions of § 60.13 of Part 60 and Section 9 of this QPS attachment.

(4) The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, in February 1995 and July 1996, respectively, and FAA Advisory Circulars (AC) 25-7, Flight Test Guide for Certification of Transport Category Airplanes, and (AC) 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

End Information

Common comments for Table of Objective Tests:

a) Test Numbering. To standardize further, it is recommended that existing test numbering should be extended to include variations in flight conditions and weight etc. As an example, b.(1) Pitch Control will be expanded to b.(1)a1 Pitch Control for Takeoff with Forward displacement, b.(1)a2 Pitch Control for Takeoff with Aft displacement, b.(1)b1 Pitch Control for Cruise with Forward displacement, b.(1)b2 Pitch Control for Cruise with Aft displacement, b.(1)c1 Pitch Control for Landing with Forward displacement and b.(1)c2 Pitch Control for Landing with Aft displacement.

b) Tolerance type of information in "Test details" should be moved to "Tolerance". For example: Engine failure speed must be within +/- 1 knot in 2.b.(2) and ... a tolerance of +/- 0.8 in (2 cm)... in 3.a.(7), should be written under "Tolerance" column.

c) Multiple weights requirement for a test should be part of "Flight conditions". Example: In 3.c.(1) medium, light and near maximum landing weights should be part of "Flight conditions"

ensure that a steady state condition exists from 5 seconds prior to, through 2 seconds after, the instant of time captured by the "snapshot."

(9) For previously qualified simulators, the tests and tolerances of this attachment may be used in subsequent recurrent evaluations for any given test providing the sponsor has submitted a proposed MQTG revision to the NSPM and has received NSPM approval.

(10) Simulators are evaluated and qualified with an engine model simulating the airplane manufacturer's flight test engine. For qualification of alternate engine models (either variations of the flight test engines or other manufacturer's engines) additional simulator tests with the alternate engine models are required. Where thrust is different by more than 5% from the flight test engine, flight test data from an airplane equipped with the alternate engine is required. Where the airplane manufacturer certifies that the only impact on the simulator model is thrust, and that other variables related to the alternate engine (such as drag and thrust vector) are unchanged or are insignificantly changed, additional simulator tests may be run with the same initial conditions using the thrust from the flight test data as a driven parameter for the alternate engine model.

(11) Motion System Tests:
(a) The minimum excursions, accelerations, and velocities for pitch, roll, and yaw must be measurable about a single, common reference point and must be achieved by driving one degree of freedom at a time.

(b) The minimum excursions, accelerations, and velocities for heave, sway, and surge may be measured about different but identifiable reference points and must also be achieved by driving one degree of freedom at a time.

(12) For testing Computer Controlled Airplane (CCA) simulators, or other highly augmented airplane simulators, flight test data are required for both the Normal (N) and Non-normal (NN) control states, as indicated in this attachment except that some tests

require data only in the Normal control state and are so noted. Where test results are independent of control state, Non-normal control data may be used. Tests for other levels of control state degradation may be required as detailed by the NSPM at the time of definition of a set of specific airplane tests for simulator data. Where Non-normal control states are required, test data must be provided for one or more Non-normal control states, and must include the least augmented state. All tests in the Table of Objective Tests require test results in the Normal control state unless specifically noted otherwise in the additional requirements section following the CCA designation. Where applicable, flight test data must record Normal and Non-normal states for:

(a) Pilot controller deflections or electronically generated inputs, including location of input; and

(b) Flight control surface positions unless test results are not affected by, or are independent of, surface positions.

(13) For computer controlled airplanes using airplane hardware (e.g., "side stick controller") in the simulator cockpit, some tests will not be required. Those tests are annotated in the "Additional Requirements" column with the Computer Controlled Airplane (CCA) note—"test not required if cockpit controller is installed in the simulator." However, in these cases the sponsor must supply a statement that the airplane hardware meets and will continue to meet the appropriate manufacturer's specifications and the sponsor must have supporting information to that fact available for NSPM review.

End QPS Requirements

B. Discussion

Begin Information

(1) If relevant winds are present in the objective data, the wind vector (magnitude

and direction) should be clearly noted as part of the data presentation, expressed in conventional terminology, and related to the runway being used for the test.

(2) The NSPM will not evaluate any simulator unless the required SOC indicates that the motion system is designed and manufactured to safely operate within the simulator's maximum excursion, acceleration, and velocity capabilities (see paragraph 3, Motion System, in the following table).

(3) In the following Table of Objective Tests, the last column is titled "Paragraph 8." A "yes" indication in that column directs the reader to paragraph 8 of this attachment for additional information relative to sources of data, procedures used to acquire the data, and instrumentation that may be used, as an alternative to those expected under normal flight test procedures and that may be used for that particular test for Level A or Level B simulators. Paragraph 8 also contains notes, reminders, and information applicable to that particular test for those simulator levels. These data sources, procedures, and instrumentation, if used, would be submitted in accordance with the alternative data provisions of § 60.13 of Part 60 and Section 9 of this QPS attachment.

(4) The reader is encouraged to review the Airplane Flight Simulator Evaluation Handbook, Volumes I and II, published by the Royal Aeronautical Society, London, UK, in February 1995 and July 1996, respectively, and FAA Advisory Circulars (AC) 25-7, Flight Test Guide for Certification of Transport Category Airplanes, and (AC) 23-8A, Flight Test Guide for Certification of Part 23 Airplanes, for references and examples regarding flight testing requirements and techniques.

End Information

TABLE OF OBJECTIVE TESTS

QPS requirements							Information notes	Paragraph 8	
Test	Tolerance	Flight conditions	Simulator level						Test details
			A	B	C	D			
2. Performance									
a. Taxi									
(1) Minimum Radius Turn	±3 ft (0.9m) or 20% of Airplane Turn Radius.	Ground/Takeoff	X	X	X	Record both Main and Nosegear turning radius. This test is to be accomplished without the use of brakes and only minimum thrust, except for airplanes requiring asymmetric thrust or braking to turn.	.....	Yes.

TABLE OF OBJECTIVE TESTS—Continued

QPS requirements								Information notes	Paragraph 8
Test	Tolerance	Flight conditions	Simulator level				Test details		
			A	B	C	D			
(2) Rate of Turn vs. Nosewheel Steering Angle.	$\pm 10\%$ or $\pm 2^\circ/\text{sec}$. Turn Rate ...	Ground/Takeoff		X	X	X	Record a minimum of two speeds, greater than minimum turning radius speed, with a spread of at least 5 knots.	.....	Yes.
b. Takeoff									
(1) Ground Acceleration Time and Distance.	$\pm 5\%$ Time and Distance or $\pm 5\%$ Time and ± 200 ft (61 m) of Distance.	Ground/Takeoff	X	X	X	X	Record acceleration time and distance for a minimum of 80% of the segment from brake release to V_R . Preliminary aircraft certification data may be used.	.....	Yes.
(2) Minimum Control Speed—Ground (V_{MCG}) using aerodynamic controls only (per applicable Airworthiness Standard) or Low Speed, Engine Inoperative Ground Control Characteristics.	$\pm 25\%$ of Maximum Airplane Lateral Deviation or ± 5 ft (1.5 m). Additionally, for those simulators of airplanes with reversible flight control systems: Rudder Pedal Force; $\pm 10\%$ or ± 5 lb (2.2 daN).	Ground/Takeoff	X	X	X	X	Engine failure speed must be within ± 1 knot of airplane engine failure speed. Engine thrust decay must be that resulting from the mathematical model for the engine variant applicable to the simulator under test.	.....	Yes.
(3) Minimum Unstick Speed (V_{MU}) or equivalent as provided by the airplane manufacturer.	± 3 Kts Airspeed $\pm 1.5^\circ$ Pitch	Ground/Takeoff	X	X	X	X	Record main landing gear strut compression or equivalent air/ground signal. Record from 10 Kts before start of rotation. Elevator input must precisely match airplane data. See 14CFR § 25.107(d).	.....	Yes.
(4) Normal Takeoff	± 3 Kts Airspeed $\pm 1.5^\circ$ Pitch $\pm 1.5^\circ$ Angle of Attack ± 20 ft (6 m) Altitude. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; $\pm 10\%$ or ± 5 lb (2.2 daN).	Ground/Takeoff and First Segment Climb.	X	X	X	X	Record takeoff profile from brake release to at least 200 ft (61 m) above ground level (AGL).	.....	Yes.
(5) Critical Engine Failure on Takeoff.	± 3 Kts Airspeed $\pm 1.5^\circ$ Pitch, $\pm 1.5^\circ$ Angle of Attack, ± 20 ft (6 m) Altitude, $\pm 2^\circ$ Bank and Sideslip Angle. Additionally, for those simulators of airplanes with reversible flight control systems: Stick/Column Force; $\pm 10\%$ or ± 5 lb (2.2 daN)), Wheel Force; $\pm 10\%$ or ± 1.3 daN (3 lb); and Rudder Pedal Force; $\pm 10\%$ or ± 5 lb (2.2 daN).	Ground/Takeoff and First Segment Climb.	X	X	X	X	Record takeoff profile at near maximum takeoff weight from prior to engine failure to at least 200 ft (61 m) AGL. Engine failure speed must be within ± 3 Kts of airplane data. CCA: Test in Normal AND Non-normal control state.	.....	Yes.